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MANAGEMENT.

THE principal reason for reproducing the greater part of Sir Daniel Hall's address to the Agricultural Education Association in the present issue of this Journal, is that the address unfolds, with great clarity and conviction, a point of view which has been striving to establish itself and will, we hope, eventually succeed in doing so, in the teaching of tropical agriculture in the Imperial College. It is earnestly hoped that readers will carefully study Sir Daniel Hall's remarks and bear in mind that, although they have specific reference to British Agriculture there is, broadly speaking, no essential difference between the aims and processes of temperate agriculture and those of tropical agriculture. In fact, the idea of education and research in "scientific *management*," which is the key-note of Sir Daniel Hall's address is, if anything more important and more easily taught in tropical agriculture, since in tropical agriculture natural conditions are more uniform and more under the control of man, while, as well, the estate manufacturing aspect as in the case of sugar, rubber and tea offers, together with overseas marketing problems enormous scope for managerial analysis, comparison and establishment of new principles and technique. And in perusing Sir Daniel Hall's address the reader should especially remember that Sir Daniel Hall was formerly Principal of the leading Agricultural College in England and later Director of Rothamsted Experimental Station. Primarily a distinguished chemist Sir Daniel Hall had to gain the point of view he now holds by years of reflection and experience. No doubt his experience in later years as one of His Majesty's Development Commissioners had much to do with it. But to return to the point of view, the essential circumstance which it is desired to emphasize is the fact that scientific management is a leading feature of the new Prospectus and Syllabus of the Imperial College of Tropical Agriculture. The Prospectus, which has virtually been approved by the Governing Body regards profitable education and training in tropical agriculture in the following light. In the first year at the Agricultural College (and it is assumed that we are dealing with an Agricultural College and not merely with an institute for research in the natural sciences pertaining to agriculture) in the first year the object is to train the students in the fundamental notions of agriculture, in those of chemistry and physics, biology, mathematics and those of the history and geography of tropical agriculture. This first year's training is regarded as an essential educationally and to be followed irrespective of vocational outlook. No matter whether a student hopes to be the manager of an estate, a sugar chemist or a plant pathologist or a Government agricultural officer, he must be trained in the fundamentals that underlie agricultural activity. Moreover without such a training he would not have the necessary intellectual equipment to enable him to specialise profitably later on. That is as regards the first year. In the second and third years the syllabus requires differentiation. That is to say, the student has to decide to some extent what his ultimate vocation in the agricultural world is likely to be. The Syllabus says there are three broad classes of opportunities of employment: (A) Management and administration (B) Biological and agricultural expert work (C) Chemical technology (chemical engineering). No absolutely hard and fast lines can be drawn between these: they are intended to indicate points of view rather than circumscribed categories. The essential difference involved in these points of view is the difference between agriculture as a

business and agriculture as a profession, *i.e.*, as a means of ancillary employment. The peculiarly industrial nature of tropical agriculture with its manufacturing features affords much scope for the professional employment of chemical engineers; the vast importance of genetics (which is really biological engineering) offers great scope also for the professional employment of the specialised botanist and zoologist; the heavy incidence of pests and diseases opportunities for the rationally trained plant pathologist. But all these possibilities presuppose the existence of agriculture as a business, which has existed for centuries and could continue to go on to some extent without these professional attachés. Important as research in natural science is, important as is scientific advice, yet without the business of agriculture they are as formless as electrons without a nucleus. The manager and what he will and can do is at the heart of agriculture. The discoveries of research and inventions can never be successfully used for the benefit of man without management, and generally speaking successful management needs the human incentive of seeing one's way to make a material profit. Moreover inventions and discoveries become common property and in the long run there is a tendency towards equilibrium of equipment. The final test of success is in management; and unless a College of Agriculture produces men who are interested and skilled in management as well as men skilled in natural science it will in the long run defeat its own object by supplying—to return to our metaphor—more electrons than the nucleus of the atom can sustain. Moreover an Agricultural College can and should help to improve those already in the position of managers by conducting economic research and by carrying on extension work. Much is being done in this way in the United States, in England and in Switzerland to reduce costs of production and facilitate marketing. This work is appreciated by the farmers and is one of the best ways of securing their interest and financial support in regard to research and advice concerning chemistry, physics and biology. But the great work of a College should be to train managers and the fact that practically all the present students of the Imperial College of Tropical Agriculture expect to obtain employment as scientific or agricultural experts and do not intend to take up business management or business responsibility, gives cause for some anxiety, and would in itself appear fully to justify the prominence given to the idea of management in this issue of the Journal. In a subsequent issue we shall consider the nature of this managerial training, the qualities required in the student and the existing and future opportunities of employment together with the rewards which can safely be expected.

Mr. William Foster, C.I.E., Historiographer, India Office, gave a lecture at the Royal Society of Arts on December 5 last on "The Archives of the Honourable East India Company."

THE TEACHING OF AGRICULTURE.

SIR A. DANIEL HALL, K.C.B., LL.D., F.R.S., *Chief Scientific Adviser and Director-General of the Intelligence Department of the Ministry of Agriculture.*

(*Substance of an address given by Sir Daniel Hall to the British Agricultural Education Association at Aberystwyth on July* 10, 1923, *and published in "The Journal of the Ministry of Agriculture" for December.*)

I want specifically to suggest the question of how the subject of agriculture ought to be treated in our Colleges and Farm Institutes, &c.; there I can see perhaps the greatest opening for better technique and indeed for some considerable reconstruction of our aims in teaching.

I think we are inheritors in this country of rather a mistaken tradition. I know quite well thirty years ago when colleges began to start in Great Britain for the teaching of agriculture, the general idea of their founders was that agriculture could be regarded as an assembly of applied sciences. There was chemistry, botany, zoology, geology and so forth, all sciences throwing light upon the growing of crops and the feeding of animals. If we first taught these sciences to agricultural students and then the application of those sciences to agriculture, we were teaching agriculture. You may remember that the first Cambridge diploma did not proceed further than that. It was content with an examination in applied sciences and treated agriculture itself as one of those rather mechanical extras which are pursued in practical life but which should hardly concern the university. So I think we were given a set towards the treatment of agriculture as just an assembly of applied sciences and it was conceived that we could bring out a farmer by grounding the youth thoroughly in chemistry, botany, zoology and so forth.

Now agriculture is a subject *sui generis*, something quite distinct from an applied science; it has its own technique and methods and its own fundamental science, which is neither chemistry, botany nor zoology, nor anything of the kind popularly termed science. It is accountancy which lies at the basis of the teaching of agriculture, and as pure chemistry is the grammar of the agricultural chemist and botany of the agricultural botanist, so is accountancy the grammar fundamental in the instruction of the farmer.

If we start off with that somewhat one-sided statement we shall get a little nearer to what is the right form of teaching. Let us begin by asking ourselves what we are after when we are dealing with the young men in an agricultural college. What is our object; what are we going to try and turn out? I think it is agreed that we are not thinking of turning out teachers, officials or that kind of man; we are thinking really of turning out a thoroughly equipped farmer and we want to ask ourselves what we mean by that—a thoroughly equipped farmer under modern conditions, and

how we can help to ensure that type of man by education. We know well the old farmer who has no education behind him ; he tells the teacher that no one can learn farming in a class room and that he has no opinion whatever of book farmers. The answer is not easy, but I think we can remove that kind of reproach if we take our teaching of agriculture from a somewhat different angle. What he means is that success in farming depends upon a number of qualities which are personal and many of which are only obtained by experience. If a man has no will or determination, if he lacks a certain firmness about making a bargain, of course he cannot become a successful farmer—and none of the efforts of the educator are directed towards giving these qualities.

Still, putting aside these inborn faculties and the essential matter of experience, what does characterise a good farmer as distinct from a bad farmer ? We can sum it up in one word—management. The good farmer not only knows what work has to be done, what good work is, the technique of growing his crops and breeding cattle, &c., but he knows how most effectively to dispose of the staff of labour that he has on that particular land. His job as farmer is a manager. The Agricultural College is dealing mainly with men who are going to be managers of labour, directors of other people's work. They are not going to do manual work themselves, except perhaps in their younger days, but in the main they are going to be heads and not hands.

When you turn to compare the successful with the unsuccessful farmer you will probably find in a great many cases that the question of financial success depends upon this disposal of labour more than anything else. We may sum up the object of the Agricultural College as the training of managers. That being the case what I want to submit to you is that we must direct our teaching to that end.

Suppose we turn to one of the most successful text-books on agriculture that we have in England, the late Professor Fream's—almost the only widely distributed text-book that has been written in English on agriculture—do you find that point of view, management, set out from the beginning of the book to the end ? There may be an odd chapter or two about it, but in the main the book is concerned with the description of the materials of the farmer. You are told how to discriminate between fescues and poas, hop trefoil and yellow clover—just the kind of things that are so much taught and learned by the agricultural student and so heartily despised by the old type of farmer. The old farmer is wrong ; you cannot know too much of anything. None of these descriptive points are without their value, only they cannot replace the other things, the vital study of the economics of a farm and its management. That is the point that I want to bring forward in these remarks.

The teaching of agriculture as I have seen it, and I speak from experience, is far too much a mere matter of description. It may not even be descriptive of the kind of farm the teacher knows himself, it may be a discussion on the old systems of farming. It is not unknown that men continue to teach the East of Scotland form of agriculture as described in Stephens' " Book of the Farm " as the only method of successful farming. It may have had little to do with the farming that was going on round about the college, having been worked out on a different rotation and for different soil and climate. Let us have done with this purely descriptive teaching of agriculture.

The teaching of agriculture should be to an increasing degree a matter of personal experience, and it should be in every district largely based upon what is going on round about the college. It should begin as a description, so far as it is descriptive, of the farming practice amongst the people the student comes from ; that is the first thing ; let us localise our teaching. In this way the teacher can introduce the element of personal investigation ; he begins by finding out what the people round about are doing, that will lead him to comparisons of their methods with other people's methods. He can fall back on the standard system of his text-book, compare it with the local system and discuss the difference that he finds between the two. The critical faculty is brought into play.

But we must go a step further if we have in view management, so that the student, when he leaves the college and begins to work on his own account, shall be in a position to be critical of the work that he gets done, and not merely in the hands of his foreman or bailiff. We must not be content merely with describing. We must ask ourselves about each of the processes, how many men, how many horses, how much time, what will it cost step by step, and criticise these costs in the light of the results. Here the real critical process comes into play. The agricultural teacher dealing with, say, the potato crop, should have acquired for himself by direct observation, a picture of the practice of a successful potato grower under certain conditions. He has followed the crop through, he has found out the number of men at work and the amount they did, and he is in a position to sum up the costs. That alone is a description which may be a great help to a student later on. But if he can set alongside that a description of the methods of two other equally good farmers and in different districts with the details of the alternative operations, the number of men on the job and costs, I should think he is entering his students in the art of being managers. That is the first step. It has not got to end there.

After the teacher has been through the raising of crops and the treatment of livestock as individual operations, he has got to get his students into a perception of how a really good farmer schemes out his work from week to week, and how, given a certain staff at his disposal, he uses them to the best advantage. From my own observation of practical farming there lies the difference between the successful and the bad farmer—the way in

which a good farmer has his work planned out and with a given staff always is ready to throw in his strength at the right moment. Of course you cannot teach that, but you can awaken the student very much to the necessity of thinking it out for himself.

It is in that connection the college farm is going to be most useful for the purpose of the teacher. The college farm should be run as a practical business proposition which is illustrating management and which is the text-book of the teacher in the lessons he is giving. Every student should keep an exact diary week by week of the operations that go on on the college farm, and it should be a diary with full details. It does not record "March 15th, sowing barley on the 10-acre field." No, he says "sowing barley on the 10-acre field; wheat stubble ploughed in November, wanted more frosts, a little stale on top and wet below." Then should follow the operations, the horses and men to each and the time taken. Further, the teacher should be giving the actual cash transactions from week to week. The teacher taking his class on Monday morning will say "our business during this week is so and so, I propose the men shall do so and so," and he shows them how he has schemed out the use of his staff during the week and the alternative in case the weather is unfavourable. It is in this way we can make our agriculture itself scientific, and not merely descriptive of accessory scientific facts which may be of value but which are of secondary importance compared with the question of management.

When we get on to the second and third year of teaching we have to consider broader economic questions; the reason for this or that branch of the business, why we are producing milk, why we are fattening bullocks, &c. We can begin with a consideration of the policy of the college farm, for it is the one which is close at hand, the one about which the teacher has the most details. But neighbouring farmers are generally willing to help the college by disclosing enough of their accounts to give the teacher materials for the discussion of policy. Now this means that agricultural teaching should be founded upon a system of cost accounting. The future of efficient management depends fundamentally upon a good book-keeping system to begin with, and the constant use of that book-keeping to check operating costs, so I think that the student must be inducted early into the point of view of cost accounting.

We are apt sometimes to assume that we can describe the right method of farming. I do not think there is a right method of farming, there is only a best compromise to adopt under given circumstances as regards soil, climate, markets, &c. The teacher's object should be to get the student into a critical way of examining other people's work so that eventually he will pass on to criticise his own work. The machinery for this is only to be supplied by a sound system of costing. Therefore the teacher of agriculture should investigate costs for himself so as to establish a comparative system of teaching, comparing A's methods with B's methods and discussing with his class how relatively they arrive at the same ends though one may cost a little more. He is then in a position to criticise the whole conduct of particular farms, always with the management in view, and the results in cash as the fundamental test of the rightness or otherwise of the operation.

I do not think I need say anything more, I could have elaborated, but I rather want to throw out these suggestions for you to turn over for yourselves and see if they will not strike on your box and modify the methods by which you teach. I am convinced that if you think about these points of the technique of teaching, you can make your work more effective.

THE JAMAICA CONFERENCE.

Under the presidency of Sir Francis Watts, K.C.M.G., the ninth Agricultural Conference of the West Indies is to assemble in Jamaica on the morning of January 29. The following is the provisional programme to which fuller reference will be made in a later number of this Journal.

The Conference is to be opened by His Excellency the Governor, (Sir Leslie Probyn, K.C.M.G.) and the Governor's speech will be followed by the Presidential Address and a subsequent vote of thanks.

In the afternoon of the first day papers will be read on "The Imperial Aspects of Tropical Agriculture," by Dr. A. W. Hill, F.R.S., SC.D., "The work of the Imperial Bureau of Entomology," by Dr. S. A. Neave; "The work of the Imperial Bureau of Mycology," by Mr. S. P. Wiltshire.

The agricultural and scientific papers will deal first with bananas. This will include "The General Aspects of the Industry in Jamaica," by Hon. H. H. Cousins (Director of Agriculture, Jamaica); "Researches relating to Bananas" (Botany and New Types) by Professor S. C. Harland, D.SC., and "Panama Disease and other Diseases" by Professor S. F. Ashby, B.SC., and Mr. G. G. Hansford. The discussion on the Banana Industry in Trinidad, the Windward Islands and Dominica is to be opened by Mr. William Nowell, D.I.C.

The second crop subject will be cacao. Under this heading on the second day the experimental work at River Estate, Trinidad, will be described by Mr. W. Nowell who with the Hon. H. H. Cousins will open the discussion of the general commercial position of the Cacao Industry, and a note on cacao will be read by Dr. S. C. Harland.

The critical situation of the Sea-Island cotton industry will be described by the Hon. A. E. Collens to be followed by "Notes on certain Insect Pests attacking Cotton" by Professor H. A. Ballou, and "Researches on Cotton and Suggested types for Cultivation in certain Colonies" by Professor S. C. Harland.

In respect of Sugar the following papers will be read :— "Notes on diseases of Sugar-cane not yet recorded in the British West Indies," by Professor Ashby, "Notes on diseases of Sugar-cane including Mosaic disease" by G. G. Hansford, Esq., W. Nowell, Hon. A. E. Collens and Professor Ashby, "Research in connection with the Sugar Industry" by R. G. W. Farnell, Esq., and experiments relating to the Sugar-cane Industry in British Guiana, Barbados, Jamaica, and Trinidad, by R. A. Altson, J. R. Bovell, Hon. H. H. Cousins, and W. Nowell respectively.

In the morning of the third day notes on Red Ring disease by W. Nowell and Professor Ashby will be read, after which a general discussion on the Coconut Industry will take place.

Citrus and other fruits will be dealt with in a paper on "Withertip and Blossom Blight of Limes," by Professor Ashby and one on the "Extension of certain Citrus By-Products" by the Hon. A. E. Collens.

In respect of Education Sir Francis Watts, Sir A. E. Shipley, G.B.E., F.R.S., and others will speak on "The Imperial College of Tropical Agriculture," while the need for agricultural education in the West Indies will be discussed by J. R. Bovell, Esq., I.S.O.

The Stock raising Industry will be discussed by the Hon. H. H. Cousins in his "Notes on Tick Control," while among other subjects to be discussed will be the extension of minor industries (including tobacco) in the Leeward Islands, by Hon. A. E. Collens, and the use of pilot balloons in meteorology with special reference to the West Indies by Professor C. G. Simpson and Dr. C. A. Matley.

The complete list of official delegates is as follows :—Jamaica : The Colonial Secretary (The Hon. H. Bryan, C.M.G., D.S.O.), The Treasurer, The Surveyor General (W. A. Baker, Esq. F.S.I.), The Hon. A. G. Nash, R. S. Gamble, E. W. Muirhead, R. P. Simmonds, A. Spooner, S. S. Stedman, The Government Entomologist (C. C. Gowdey, M.Sc., F.E.S.), The Government Microbiologist (C. G. Hansford, B.A.), The Government Veterinary Surgeon, The Superintendent of Agriculture (P. W. Murray) The Secretary, Jamaica Agricultural Society (John Barclay), The Director of Agriculture (The Hon. H. H. Cousins, M.A.) ; British Guiana : R. A. Altson (Assistant Government Botanist); Trinidad : W. Nowell, D.I.C. (Assistant Director of Agriculture), W. S. E. Barnardo, M.A. (Chairman, Agricultural Society) ; Windward Islands : Hon. Joseph T. de la Mothe ; Barbados : J. R. Bovell, I.S.O., F.L.S., F.C.S., &c. (Director of Agriculture) ; Leeward Islands : R. Nosworthy (Recently Acting Administrator of Dominica) ; British Honduras : E. Stanley Woods, J.P. ; Bahamas : G. A. Albury ; Bermuda : E. A. McCallan (Director of Agriculture) ; Imperial College of Tropical Agricultutre and Imperial Department of Agriculture : Sir A. E. Shipley, G.B.E., LL.D., Sc.D., F.R.S. (Chairman), G. Moody Stuart, (Chairman of Finance Committee), Sir Francis Watts, K.C.M.G., D.Sc., &c. (Principal Imperial College of Tropical Agriculture and Imperial Commissioner of Agriculture for the West Indies) H. A. Ballou, M.Sc. (Professor of Entomology and Assistant Commissioner of Agriculture), S. F. Ashby, B.Sc., (Professor of Mycology), Dr. S. C. Harland, D.Sc. (Professor of Botany), A. E. Aspinall, C.M.G., B.A. (Secretary) ; Royal Botanic Gardens, Kew : Dr. A. W. Hill, F.R.S., M.A., Sc.D., F.L.S. (Director) ; Imperial Bureau of Entomology : Dr. S. A. Neave (Assistant Director) ; Imperial Bureau of Mycology : S. P. Wiltshire (Assistant Director) ; West India Committee : E. A. de Pass, A. E. Aspinall, C.M.G., B.A. ; British Empire Sugar Research Association : R. G. W. Farnell, B.A. (Chemist).

VEGETABLE FUEL OIL.—In the last issue of "Tropical Agriculture" we referred to important results in connection with the use of vegetable oils as lubricants. In continuation of this it may be noted that interesting work is being done by Professor L. Mailhe in France and M. Sato in Japan on the conversion of vegetable oils into substances which closely resemble mineral oils. By catalytic hydrogenation colga oil has been split up into fuel oil, lubricating oil or grease and other products of petroleum distillation. For some years palm oil and ground nut oil have been used as fuel in the Belgian "Drott" engine and motor boats on the Congo have been run with this oil more or less successfully. As a correspondent in "The Times Trade and Engineering Supplement" points out, although petroleum supplies will certainly be plentiful for at least another 20 years and coal for a great deal longer period, vegetable oil and alcohol will be inexhaustible as long as oleaginous and starchy plants and trees can be grown upon the earth. One day undoubtedly tropical agriculture will furnish a large proportion of the world's transport power and although this day is distant it does not lessen but rather accentuates the value of experimentation in the interval.

Vultures are often conspicuous objects in tropical towns, and their antics when drying themselves in the sun after heavy rain are well worth watching. Sight is the chief sense that draws them to their food, but Mr. C. B. Williams, M.A., now in Egypt and formerly in Trinidad has shown that smell is also a factor.

"The Malayan Agricultural Journal" for July, August and September states that the total cost of production of half an acre of sweet potatoes, planted at the Experimental Station, Malay, was $29.85. Profit per half acre $18.60.

The U.S.A. Experiment Station Record for September gives tables for the conversion of the measures used in Brazilian agriculture into the metric system.

RESEARCH ON LIVESTOCK.

PROFESSOR J. SYDNEY DASH, B.S.A.

It is generally recognized that the quality and quantity of livestock in a community is a good indication of the agricultural progress and development of that community. Unfortunately this important consideration in agricultural progress has hardly been given the attention it deserves in the tropics where everything is expected to flourish with little or no direction by man. To a northern agriculturist who has learnt to appreciate to the full the value of livestock, the lack of care so frequently seen is little short of amazing, while a tropical visitor to Smithfield or Chicago might wonder how it could be possible to secure the quality and finish so much in evidence at those great livestock shows. It is true the business side of animal production, like so many other branches of agricultural effort, has been seriously neglected in the tropics and scarcely any reliable figures exist as to feeds, feeding, gains and costs. Rarely is an animal ever weighed, except when offered for sale. Little attention has been paid to the keeping of accurate animal records, and in the case of working stock, crediting them with work performed as is done in countries where systematic cost accounting is practised. The general appearance of an animal is taken as an indication of the suitability or otherwise of the food and care given.

Concerning the question of general care, attention might perhaps be drawn to certain remarks on rumination by Mr. Begg in a recent number of the "Veterinary Record." "In properly conducted byres, the factors that are potent to excite the cattle and so disturb rumination are carefully eliminated, because it is well recognized that only under a regime of almost perfect quietude in the cowshed, gentleness in handling of the cow, and an almost entire absence of circumstances that by sight or hearing or sensation upset the natural complacency of the cows, can the maximum yield of milk be obtained. The exceeding value of suitable periods of rest and quietude, to permit of proper rumination, is well understood by those experienced in charge of yoke oxen. Although this interferes materially with the speed of the trek, it must be provided for otherwise the animals soon fall off in health and condition, and are incapacitated for further work."

Failure to recognize the importance of rumination is no doubt one of the many causes of ill-conditioned working herds so frequently seen in tropical countries. Another consideration to which some attention might be given is that of regulating the hours of work. With efficient management, heavy work such as ploughing is not usually done in the heat of the day but confined where possible to the early and late hours of the morning and afternoon respectively. The care of pastures particularly in respect to shade, drainage, tick infestation and water supply often leaves much to be desired.

Such a condition of affairs is perhaps surprising, since animals are required in large numbers for labour, meat and milk apart from the value of the manure produced—the latter a most important consideration where exploitive agriculture is yearly taking a heavy toll of the fertility of tropical soils. The situation may indeed be regarded with some alarm even in countries specially favoured by nature, and where intensive and deep tillage has been resorted to in order further to tap the potential resources of the soil. In any case, successful permanent agriculture depends on the extent to which soil losses are made good, and in this connection it is the humus supply, so easily depleted under tropical conditions, that above all must be maintained. The relationship between crops, stock and humus has long been understood in settled agricultural countries.

As an example of a successful livestock country with tropical conditions, we may take the case of India. In 1920 it was stated to lead the world in number, being credited with 318,000,000, including cattle, buffaloes, sheep, goats, mules, horses and donkeys. In 1916-17, the value of skins, raw and tanned, exported from India amounted to £15,800,000. This perhaps should be taken as a tribute to the work of the various Departments of Agriculture in the suppression of pests, and to the care and patience of the native whose reputation as a stockman is well known in the West Indies. Other countries in the tropics do not seem to be favourably placed, on the other hand; figures at the moment are not available, except for Mauritius, which according to the statistics in 1919 showed a decrease of 8,000 head during the previous four years. In the West Indies, the large number of animals imported every year indicate that there is abundant scope for home production, and the raising of stock should be given greater consideration in the economy of many estates than it is at present. The price of a commodity such as pork so easily raised with home-grown foods should be an incentive to proprietors, both large and small, to keep pigs, if only on a small scale. Moreover, with the world's present overproduction of grains and cereals and the underproduction of animals and animal products, the prices of the latter will tend to keep high.

Being mainly occupied with crops, Agricultural Departments in the tropics have not in the past, given sufficient attention to this livestock question, at least in all its phases. It has become increasingly evident that animal studies must go hand in hand with plant studies if agricultural industry is to be fostered and maintained. As in England, private individuals have done much to introduce new breeds and strains and to encourage livestock associations. Governments have emulated their example and in many cases extended considerably this line of activity to include the breeding of types suitable for special conditions and also the study and treatment of diseases and pests. Much remains to be done,

however, on problems connected with animal nutrition. What is a ration ? In the present state of our knowledge is a satisfactory answer to this question possible in respect to tropical requirements for maintenance and production (including work)? Obviously not. It has been left to northern countries to show us the value of such tropical feeds as coconut and cotton seed meal, and we rely largely on their experiments as a guide in using these substances. Similarly, the true value of molasses as a stock food is but imperfectly understood. These are only three of the many useful feeds that the tropics can produce abundantly ; as is well known, unlimited possibilities exist for the production of many others. At present, the tendency is to sell cheaply and buy dearly our principal stock feeds.

In conclusion, while much has been done in the selection and breeding of animals suitable to tropical requirements, the importance of using only male animals of superior character in the grading up of herds, whether for milk, meat or work needs to be emphasized and brought home to all those engaged in agriculture in the tropics. Efforts to increase the number and quantity of all kinds of livestock by better breeding, care and management, should be encouraged in every way. But above all, what is required, is organized research to study problems relating to animal nutrition, to study feeds, feeding and costs and to disseminate this knowledge so that stock raising may become a stabilized business in the tropics, which can produce all the feeds required, instead of the uncertain, haphazard venture it now appears to be. Intimately associated with and almost unseparable from such problems are those of maintaining the fertility and humus content of tropical soils, which also offer a wide field for research. The investigations now in progress at Rothamstead should stimulate tropical workers as to the possibilities awaiting them in this direction. Given facilities, the Imperial College of Tropical Agriculture would be in a position to undertake research work along the various lines indicated and to combine it with that on tropical crops, the necessity for which was clearly put forward in the last number of this journal.

B.C.G.A. REPORT.

The monthly meeting of the Council of the British Cotton Growing Association was held at the Offices at Royal Exchange, Manchester, on December 4, Sir Frank Forbes Adam, Bart., C.B., C.I.E. in the Chair.

In regard to Nigeria, it was stated that the reports received from the Northern Provinces continue to be most promising, and the condition of the growing crop generally is better than in any previous year at this time of the season, so that it is confidently expected that at least 15,000 bales of improved long stapled cotton will be forthcoming from this area. The development of cotton growing both in the Southern and Northern Provinces of Nigeria is largely restricted by the lack of transport facilities ; the authorities are now becoming more alive to this question which is most vital at the present time, and recently a very strong case has been drawn up for the Government dealing with the transport requirements in the different Colonies and Protectorates. The new cotton crop was expected to come in towards the end of the year, and the Association intended to pay the highest price possible, based on current Liverpool values, in order to encourage native growers. The purchases of cotton in Nigeria to October 31, amounted to 15,613 bales, as compared with 13,109 bales for the same period of last year.

Concerning Uganda, the latest bulletin issued by the Department of Agriculture stated that the crop prospects were good throughout the Eastern Province, and although insects have done damage in isolated areas to the earlier planted cotton, the loss has been slight. The approximate area planted in the Eastern Provinces is estimated at 296,444 acres, a considerable increase having taken place in Budama and Northern Lango. The prospects in the Buganda Province are reported to be very good, and it is estimated that Uganda this season will produce a record crop of 120,000 bales, compared with some 85,000 to 90,000 bales last year.

From the Sudan a very encouraging report has been received, and this season's crop is estimated at 35,000 bales of superior Sakellarides cotton, and 7,500 bales of long stapled American cotton making the total production of cotton in the Sudan for the season, 42,500 bales.

As regards Australia, statements have recently been made to the effect that the boll weevil has made its appearance, and had this been the case it would have been a most serious matter for the future of cotton-growing in that continent. As a result of careful enquiries made by the Association, however, a cablegram was received from Col. Evans, the Expert who was sent to Australia by the Empire Cotton Growing Corporation, reading :— " No signs weevil Australia. Press confused with " pink boll worm in Northern Territory." So far as can be ascertained, there is no evidence of the existence of the boll weevil outside of the continent of America.

It is stated in the " Journal of the Royal Society of Arts " of October 19 that the Uganda may be depended upon to furnish 100,000 hides and skins annually. In 1922 there were more than 1,000,000 head of cattle, 700,000 head of goats, and 250,000 head of sheep. The great problem in this and other countries in East Africa is the control of fatal diseases.

THE TROPICAL WORLD.

CEYLON.

The Progress Report of the Peradeniya Experiment Station for last September and October shows that one result of the heavy pruning of tea has been a vigorous growth and decrease of shothole borer trouble. The tea under Gliricidia shade. however, has been found to be badly attacked by the borer, the shade trees also serving as a host plant. As the result of wet weather canker of cacao was found to be very much on the increase. Coffee appears to have benefitted by a manurial application of castor cake and ashes. A Sub-Committee of the Estates Products Committee has reported to the effect that more up-to-date equipment is required at Peradeniya, especially for the preparation of rubber and for the curing of cacao.

MOZAMBIQUE.

Development prospects in the Portuguese Colony of Mozambique appear to have been greatly strengthened by Dr. Soares' recent negotiation of a large loan in London which will be used by Portugal for the benefit of her East African territory, Sugar production is already a big industry in this territory and the view taken in England, indeed, a condition of the loan, is that machinery and materials shall be purchased in the United Kingdom. It does seem unfortunate, however, that British capital should more readily flow in this way to foreign colonies when there are British colonies equally in want. Concessions and labour supply are usually the dominating factors in these matters and there is no doubt that British Guiana, for example, which needs both capital and people is wise in concentrating on the latter as she has done in sending the Hon. Sir J. J. Nunan and Mr. Luckoo, K.C. on an important immigration mission to India.

MALAYA.

Planters in the Federated Malay States and Ceylon continue to exert pressure in regard to the need for higher remuneration and better facilities for leave and pension. It is proposed to form a deputation of leading Malayan managers in order to put matters more definitely forward. Much on this subject has appeared in Journals such as "The Planter," (F.M.S.) and in England in "Truth" and "The Field," and it would appear that a satisfactory adjustment is imminent by virtue of the spirit of mutual respect and consideration that characterises the tone of all discussions and expressions of opinion on this important matter.

Concerning plantation work itself, it now appears to be generally accepted, both in the F.M.S. and in the Dutch East Indies, that the old method of planting unselected rubber at fairly wide distances is wrong. While the final economy of procuring and planting bud grafts alone is not fully agreed upon, it is acknowledged that the best proceeding is to employ both bud grafts and seedlings from selected trees and plant them alternately closer together, thinning out in subsequent years as the capacities of the trees are confirmed by practical experience. A reliable report states that Dutch yields are falling off in Java and Sumatra owing to excessive tapping and disease. This may be partly responsible for the relatively recent change of opinion in Java and Sumatra in regard to restriction.

NIGERIA.

Dr. T. G. Mason, SC.D., M.A., Senior Botanist, Department of Agriculture, and formerly Botanist in the Imperial Department of Agriculture for the West Indies sends us an interesting letter from Ibadan, the Headquarters and research centre of the Nigerian Department. Dr. Mason finds Nigeria a good place for work and has been carrying on important research in connection with factors inhibiting the growth and fruiting of cotton in Southern Nigeria. Some interesting work is also being done by Dr. Mason with yams, which plant, in his own words "is strangely interesting sexually." Cotton, cacao and oil palm are the chief crops in Southern Nigeria and at the time Dr. Mason wrote the Harmattan was on—a very dry wind from the desert. It will be recollected that Dr. Mason successfully initiated the important hybridization work with bananas at the Imperial College of Tropical Agriculture just before proceeding to the West Coast early in 1923.

COLOMBIA.

Recent reports show that this Republic is steadily progressing and yearly developing its vast resources. We understand that on the initiative of the Society of Agriculturists of Colombia the Government summoned in January at Cartagena, an International Assembly representing the countries which produce mild coffee. The following countries were represented; Mexico, Guatemala, Honduras, Salvador, Nicaragua, Costa Rica, Ecuador, Colombia, Venezuela, Cuba, Jamaica, and Porto Rico. Among other matters for discussion at this Conference were the collection of statistics of mild coffee, methods of tillage and cultivation, the diseases of coffee, the formation of one standard type of mild coffee which can serve as a basis for future transactions and lastly the creation of warehouses at the different maritime ports. It may be mentioned that "mild" coffee, *i.e.*, coffee of high grade, has a special market of its own. There are for instance brokers in Front Street, New York City, who handle nothing but "mild" coffee.

MAURITIUS.

Reports indicate that the Mauritius Agricultural College has made an excellent start under the able direction of Dr. H. A. Tempany. Dr. Tempany was formerly Government Chemist and Superintendent of Agriculture for the Leeward Islands in connection with the Imperial Department and went to Mauritius as Director of Agriculture in 1915. An authority on the chemical technology of sugar production, Dr. Tempany has been able to exert a

valuable influence in Mauritius (the largest sugar-exporting colony of the Empire.) In Mauritius during recent years, a striking feature has been the rapid increase in the area of sugar-cane cultivated by East Indians who are a preponderating element in the population (as they are in Trinidad) forming over two-thirds of the total.

BRITISH GUIANA.

The local press has been full of encouraging articles and reports concerning the Imperial College of Tropical Agriculture, thanks to the focussing influence of Sir Arthur Shipley's recent visit. "The Daily Argosy" in reference to the College's research programme outlined in our last issue says: "This is a programme of highly important work which may have results directly beneficial to sugar-planters and to those engaged in every other form of agriculture in this part of the world, and taken in conjunction with yesterday's speech by Sir Arthur Shipley it must be conceded that the Imperial College of Tropical Agriculture has made good its case to substantial support from British Guiana." This is exceedingly gratifying and the most practical way of responding is for the College to demonstrate its anxiety to co-operate with British Guiana in respect of the investigation of some of that Colony's specific problems. In any case British Guiana with its continential conditions, its peculiar features of transport and cultivation is an indispensable study-ground for the student of tropical agriculture. No student should consider his College course complete without a visit to British Guiana especially in respect of sugar production and the great possibilities attendant on the development of continental areas which have been so widely promoted by the investigations of Professor Sir John Harrison, M.A., the Colony's distinguished Director of Science and Agriculture.

NEW GUINEA.

Some valuable information concerning this remarkably interesting territory has recently been supplied by Mr. P. A. de Verteuil, who has arrived in Trinidad after two years sojourn in that country. The largest island in the world and with a central range of mountains culminating in the snow-capped peaks of Carstenz, 15,964 feet above sea level, New Guinea possesses several distinct climatic zones of which the most important is the intensely tropical region of the coastal lowlands. Here and particularly in the outlying islands very large quantities of coconuts and copra are produced many of the plantations being of German origin. The Trobiads are the best of the native agriculturists and apparently specialise in the growing of yams. Anyone entering their territory, states Mr. de Verteuil, is particularly struck by the local yam house. The yams grow all over the house from top to bottom. This yam house is owned by the Chief. As well as possessing agricultural resources New Guinea has important deposits of minerals amongst which may be mentioned gold and petroleum. The country presents administrative difficulties, but as soon as certain desirable reforms are introduced New Guinea is likely to develop into one of the leading tropical countries of the Southern Seas.

HAWAII.

Labour conditions this year are much improved, the result in large measure, of increased immigration from the Philippines an outcome of the activities of the Hawaiian Sugar Planters' Association. The Filipino population of Hawaii is now between 35,000 and 40,000, and for the first time in many years the Japanese take second place in point of numbers employed in the sugar industry which leads the world in point of manufacturing efficiency. Sugar production costs, however, are higher in Hawaii than in the other tropical territories of the United States, as for example Cuba and Porto Rico. Outside of sugar the principal Hawaiian interest lies in pineapples, the production of which has reached a prodigious figure and is increasing. In connection with minor matters lately a small but very interesting event has been the transplantation of large trees in Hawaii. Date palms and coconut palms, all mature trees, about twelve years old have been successfully transplanted. Ability to do this is often of great convenience where gardens are being re-arranged or a building site adjusted to suit the requirements of building construction.

SOUTHERN CHINA.

Dean John Henry Reisner, B.A. (Yale), M.S.A. (Cornell) head of the University of Nanking College of Agriculture and Forestry, furnishes some exceedingly interesting news in the last annual report of this remarkable institution. It would appear that the work of the College is progressing in every sphere of activity and especially in regard to research and extension work. Obviously in a country like China extension work on account of languages and customs presents considerable difficulties; but by means of institutes, exhibits, plays and demonstrations Dean Reisner and his highly qualified staff have got into real touch with the rural communities. Amongst the illiterate a large amount of teaching, especially in relation to cotton improvement is done by means of ingenious pictorial charts, so that the planter can, for instance, catch the main idea of a greater income from improved cotton and cultivation. A feature of the Nanking College which, by the way, is located in more or less tropical conditions in about the same latitude as New Orleans, is its close co-operation with the missionary interests. Further, the gift of twenty-one thousand dollars in gold from the Silk Association of America gives the College the best equipped sericultural establishment in China. The College is also supported by funds furnished by the Cotton Mill Owners' Association of China, while negotiations for the allocation of seven hundred thousand dollars gold for famine prevention work have been brought to a successful conclusion in America.

LAYING OF FOUNDATION STONE.

On January 14, in the presence of a large and representative gathering, His Excellency Sir Samuel Wilson, K.C.M.G., K.B.E., C.B., Governor of Trinidad and Tobago, laid, after a boldly conceived and broad-minded speech, the foundation stone of the new College building. An intensely gratifying feature of the ceremony was the presence of Sir Arthur Shipley, G.B.E., SC.D., F.R.S., Chairman of the Governing Body, who, together with Dr. Arthur Hill, SC.D., F.R.S., the Director of Kew and Mr. A. E. Aspinall, B.A., C.M.G. (Secretary of the College), made the long voyage from England for the occasion. This, and the inspiring and gracious messages received from His Royal Highness the Prince of Wales, from Viscount Milner and Viscount Burnham, and the happy wishes of the great Empire Cotton Growing Corporations, were features which, together with His Excellency's presence as representative of the King, every member of the College, both Staff and students, deeply appreciated. All through—in His Excellency's speech, in the messages from England, and in the speeches of Sir Arthur Shipley and Dr. Hill—the real importance of the College as a centre of education and research in tropical agriculture was fully emphasized ; and Sir Francis Watts, K.C.M.G. (the Principal) ably strengthened this note by reference to the College work—particularly the research work—that has already been done with existing accommodation and equipment. Perhaps, had time allowed, more might have been said concerning the new building itself: that its massive proportions stand for permanence and efficiency—not merely material permanence and efficiency, but belief in the permanence and efficacy of an idea. The whole significance of what was in every way a uniquely successful and extremely important function, was the demonstration of confidence and wide-spread interest in a great College idea. But we, of the College, must not be too elated over this ; as our motto says: *Via calendi hoc facilis.* We have still much in front of us to justify it.

COMPANY RUBBER PRODUCTION.

There is a tendency amongst students of tropical agriculture—at least in the West Indies—to exhibit some lack of appreciation of the difference between company and private administration of tropical estates. One valuable feature of company administration from the student's point of view, consists in the annual general meetings at which are made, especially in the case of rubber companies highly interesting announcements which, if studied with discretion, provide useful information concerning finance and costs, general agriculture, and technical management. These reports of rubber meetings are usually published at considerable length in the "Times" and in an abbreviated form in "Truth" and "The India Rubber Journal," and the following extracts taken from a recent issue of the first-named paper describes the position last year of a large Ceylon estate the development of which was begun in 1910, and subsequently retarded, until recently, by unavoidable circumstances.

The Chairman of the Company in the course of his speech said :

"Owing partly to the comparatively slow growth in Ceylon, partly due to continuous damage in our earlier years by wild animals nibbling off young trees and partly to the fact that in 1910-11 we started with nothing but jungle, except about 50 acres of scattered rubber trees and some little tea, the earliest date at which we could reasonably have expected to reach the dividend stage was 1918-19, but the upset caused by the war followed by the slump in rubber just synchronized with the time when in the ordinary way we should have been able to commence distributing dividends.

"I believe that with reasonable care and foresight in running the company and building up gradually both the property itself and the necessary cash reserves we are now assured of crops that will compare favourably with those of the bulk of rubber companies as regards quality of produce and cost of production, and we hope a little later and with liberal cultivation that our average yield per acre will be 400 lb. all round or over 600,000 lb. of rubber, while our property as regards equipment, condition, management and repute should be the equal of any estate in Ceylon. You may rest assured that the untiring efforts of the whole board will be concentrated on achieving that objective.

"With regard to our report it will be noticed that foremost is the disappearance of the £5,500 bank loan, carrying interest, and the mortgage attached thereto. We are absolutely free and our own masters. Taking our resources as at November 30, cash in hand, London and Ceylon, amounted to £5,260 11*s.* 10*d.* Stock of rubber in London, in transit, or awaiting shipment in Colombo (but excluding the November crop figures, which have not yet come to hand) came to £3,620 4*s.* 7*d.*, or £8,880 16*s.* 5*d.*, in all, while liabilities due or accrued to that date amounted to £520. In addition, there are ordinary estate bills due in January, February and March amounting to £1,600 in all. Deducting these, our net available resources at November 30, were £6,760 16*s.* 5*d.* against £4,300 a year ago, which is satisfactory, especially so as a year ago we were behind with our preference interest while to-day all arrears are paid off.

"Perhaps the most pleasing feature of the past year has been the marked reduction in costs, the actual cost of the rubber estates being 4·97*d.* a lb.; Homodolla is as low as 4·87*d.*; while our f.o.b. costs have come down from 6·40*d.* to 5·52*d.*; a low and very satisfactory figure. This is greatly to the credit of our manager, under whose skilful control the estates have greatly improved, and I hope that when he comes home on leave next spring you will cordially agree with the board in voting

him a substantial bonus to lighten the expense of his holiday, remembering that upon your estate manager depends almost everything—he it is who makes or mars a property.

"The Visiting Agent reports on the properties that they show every sign of good and careful management; they are thoroughly well looked after and quite a different proposition from what they were three years ago. There is very little disease except pod and leaf disease, which appears to be very prevalent this year owing to the abnormally wet season and the record rains—140 wet days out of 141, *i.e.*, nearly five months' continuous downpour. High cultivation and manuring are believed to be the best remedy to counteract this; we have already authorised an expenditure of Rs. 20,000 on this, and if when more normal weather conditions prevail leaf trouble still continues, we may have to manure more freely still.

"Under the restriction scheme, our crop will probably drop this year to about 250,000 lb., and the smaller crop, combined with more liberal manuring, will probably bring our all-in-cost up to about 9*d.* a lb., while I hope to average over 1*s.* 3*d.* or say, about 6*d.* a lb. net, which would mean a profit of, say £6,000. We give you quite exhaustive figures of our costs, and you will understand that while restriction ensures us a better price, it also makes a distinct addition to the cost per lb., apart from extra manuring; but, taking the soundest market views of the situation carefully compiled by Sandersons, it would appear that on the 60 per cent. restriction basis production will probably fall short of consumption by about 70,000 tons, which would make the present position very sound and hopeful, and should allow us all a somewhat larger output.

"The expansion or contraction of demand for all commodities ever forms one of the most baffling and elusive of commercial problems, the solution of which defies even the most expert calculations, and as in tea so may it be in rubber, and the unexpected may happen—either way. Big markets that have been more or less closed or stagnant may revive or active markets may record a setback; it is most difficult to see just what course the rubber market is likely to take, though the restriction scheme points to an average in excess of 1*s.* 3*d.*, which is a very low figure from our standpoint.

"The question of the rupee exchange is naturally giving Ceylon companies a little anxiety, but we have partly provided against it as far as we are able by purchasing rupees in advance. Improved Indian trade is stated to be the cause of the appreciation in the value of the rupee, which affects our costs so markedly. Our labour, fortunately, causes no trouble; we have at present ample.

"The important question of providing for the gradual depreciation of our property, or shall I say?—wearing out by natural process of the trees, which we might put at 35 years from planting, although no actual data are yet available, will, I think, in our case be eventually provided for by the gradual opening up of reserve jungle, of which we have a splendid block of about 1,300 acres, as well as by the replanting of the oldest fields when they eventually decline.

"Bud grafting—to which I referred last year—is still in the transition stage; it is like free trade and protection, with plenty of protagonists on both sides, and no one is able to say definitely what its ultimate effect will be though on ordinary horticultural grounds I still believe it will prove valuable and remunerative."

The most important matter referred to in the above remarks, is, we think, from the point of view of estate management and finance, that in the last paragraph but one. Lack of agreement on the principle of depreciation is one of the great setbacks to the application of cost accounting on tropical estates.

INDIAN SCENERY.

A well-known English novelist writes to us from India: "Southern India is exactly like the India of one's childish imaginings—all tropical jungles and lakes and vast old Hindu temples, all quite un-Anglicised (even Akbar broke his teeth on it!) Northern India is fiercely Mahommedan.....In Southern India the soil is richly, deeply red; Northern India is pale as a bleached bone. In the southern states the jungle is vast, deep and green; in the North it is scrub. But fascinating as the old Hindu temples of the South are, with courtyard after courtyard, great tanks on the steps of which the women stand holding out their red and orange saris to dry and walls of carved pillars and towering gopuras standing up like gigantic wedges against the sky crowned with golden horns —still for pure beauty they cannot touch the buildings of the Moguls in the North.

....Now we are in Kashmir after a terrifying drive of 100 miles over a pass which is only just open —still full of snow, landslips, boulders and what not! I think Kashmir is what people always say, the most beautiful place in the world. We have been drifting down the Jhelum all day and are now in a great lake, all round us the snow mountains at the lake's edge masses of peach and pear and cherry trees in full blossom; beneath them acres of mustard like sheets of living gold. And the mud roofs of the little over-hanging houses are covered with grass as green as emerald and the red and white tulips are beginning to show amid it. Before we came here we stayed with the Governor at Peshawar (we have divided our time between Viceroys and Governors on the one hand and dâk bungalows and bazaar boats on the other) and from there we were given an armed escort and went through the Kybar pass and I went over into Afghanistan, which is strictly forbidden ....But most attractive of all places we have been to is Burma. We went in a bazaar boat right up the Irawadi to the frontier of China. I spent hours on the China road where the caravans come in over the great pass. And Mandalay? It is like something on a lacquer screen rather than a real place!"

RECENT CHEMICAL RESEARCH.

THE CHEMICAL CHARACTERIZATION OF COTTON.—Among the numerous lines of investigation to which the cotton fibre is being subjected at the Shirley Institute in Lancashire, the researches into its chemical composition and behaviour are yielding results of far reaching importance. The scattered literature of the chemistry of cotton has been fully reviewed in several of the Institute memoirs by Dr. Fargher and his co-workers, who themselves have added materially to our knowledge of the subject, notably by their studies of cotton wax, and of the action of water and caustic alkali on cotton. These studies have considerable bearing on the mechanism of the bleaching process and on the behaviour of cotton during manufacture.

In a recent memoir of the Institute (Vol. II, No. XVIII, Sept. 1923), Dr. Clibbens in collaboration with Miss Birtwell and Mr. Ridge, have described an interesting method of chemical analysis of cotton by a study of its absorption of a basic dyestuff, methylene blue. They have demonstrated that carefully bleached cotton absorbs small but measurable quantities of methylene blue, the amount of absorption depending on the origin of the cotton. Thus, bleached Egyptian cottons show significantly higher absorptions than do bleached American cottons, and the method may be employed as a means of detection of the source of cotton in any given cotton material. Unbleached cotton, on the other hand, absorbs much greater quantities of the dye, a property which is attributed to the presence of "impurities" such as protein and pectin. The bleaching process removes these substances from raw cotton, and the dye absorption method may therefore be used also in testing the efficiency of the bleach.

Although no direct determinations of the protein and pectin contents of raw cottons of different origins and ages were made by Dr. Clibbens and his associates, the results are in accord with the known properties of those substances. A recent investigation in the laboratory of the Imperial College of Tropical Agriculture has indicated that raw cotton may contain as much as 1·2 per cent. of pectin. A sample of Sea Island cotton, reaped in March, 1922, was extracted with warm dilute hydrochloric acid in a vacuum apparatus, and the dissolved pectinogen precipitated as calcium pectate by the method of Haynes and Carré (Biochem. Journ. XVI, 1922, p. 60). It would be of interest to follow the changes in the pectin content of raw cotton on storing, since it is known that pectin is especially prone to attack by certain bacteria and fungi.

F. H.

In a paper on "The Pectic Substance of Sugar-Cane Fibre" in the "International Sugar Journal" for December, 1923, an account is given by R. G. W. Farnell, A.R.C.S., A.I.C., of research work carried out by him at the Imperial College of Tropical Agriculture from March to July of that year under the auspices of the British Empire Sugar Research Association.

From a short study of the pectinogen in cane fibre (in which it is present up to 1 per cent.), it appears that different methods of clarification should not extract widely differing amounts of the pectinogen contained by the *bagacillo* in the mill juice. Precipitation of the pectin will not occur unless the juice is limed alkaline. At present it is impossible to state the quantity of pectin that may be removed from solution by absorption at the surface of kieselguhr, or substances precipitated *in situ*, such as calcium sulphite and calcium carbonate in the sulphitation and carbonation processes. In a previous report (I. S. J. 1923 248-251) some results were given of the absorption of pectin by "Norit" carbon. Further work is required to study the soluble pectin of the juice and its precipitation at different H-ion concentrations. The precipitation of xylan will also be studied, and an attempt will be made to isolate the hemicellulose of the cane.

FIELD AND GARDEN.

Uba cane has made a vast amount of difference to sugar production in many countries. Although Uba cane gives a lower return of sugar per acre than seedling canes do and possesses defects from the factory standpoint, its production costs are less and it is therefore an economical cane to grow especially if cultivated on a large scale where land is remarkably cheap and a thick growth is necessary for purposes of weed control. Uba is also resistant to mosaic disease.

In Jamaica, the Agricultural Society is constantly advocating increased and more careful planting of coffee. On the very steep slopes, not only is there a constant shifting of the surface soil but there is the danger of landslips occurring during abnormal rains. In laying out new fields it is advisable to save as many trees as practicable. Even if these are not desirable shade trees they may be regularly lopped off giving them still a root hold on the soil. This would greatly reduce the risk of having landslides as the living roots hold the soil together while the decayed roots increase the tendency to slipping. At present, to avert the danger, there should be judicious system of blind trenches. These will provide surface mulch, break the force of the water during heavy rains, and also collect the surface soil and humus which are carried away by even average showers.

Short trenches of from quarter of a chain to half a chain, and not nearer than half chain apart will meet the case. They should be 2 feet wide, and 18 inches deep on the lower side. The sides instead of approaching the perpendicular should be carefully pared off from above the outer edge leaving no overhanging earth which invariably breaks away during rain.

Practical attention is being given in Jamaica to the establishment of a silk worm industry. Lectures have been given and a technical adviser has interviewed a large number of prospective cultivators. Plants are to be ready for trial feeds with silk worms in a few months' time.

NOTES OF INTEREST.

The Egyptian Ministry of Agriculture estimates last season's cotton crop at 5,844,000 kantars (1 kantar of unginned cotton equals 315 lb.).

The total export of tapioca of all grades from British Malaya in 1922 was 34,402 tons valued at £581,255.

Owing to damage caused to rubber by the opening up of the cases for sampling purposes it has been recommended for general adoption that the sheets should be dusted with French chalk and wrapped in paper.

In 1905 the world's production of wild rubber was 62,000 tons supplemented by 145 tons of plantation rubber. In 1922 the production of wild rubber had fallen to 25,000 tons while plantation rubber had run to 355,000 tons.

The West Indian Island of Grenada is planting bananas and nutmegs "in every available corner" according to a recent report—as the most hopeful way of lessening the effects of the low price of cacao—the crop which constitutes this Colony's chief industry.

The total Chinese cotton crop is estimated at about four million bales or as much as is produced in good years in India. The known commercial crop in China certainly exceeds one million bales, and with the help of such institutions as the Nanking College there is little doubt that it will increase in quantity and improve in quality.

Attention is editorially directed to the Imperial College of Tropical Agriculture as a school for the study of rubber planting in the *India Rubber World* of December last. Mr. H. C. Pearson, F.R.G.S., the well known editor of this paper has travelled extensively both in the Eastern and Western tropics, and is the author of several important works connected with rubber.

The summary of the results of trials with variously treated railway sleepers reported on by Mr. R. S. Pearson, C.I.E., I.F.S., in "Forest Bulletin" No. 53 (Dehra Dun U. P.) shows that "powellising" and the introduction of creosote have given good results. To treat sleepers with chloride of zinc, followed by a small coating of creosote or to treat with a small quantity of high grade oil is economically unsound, though cheaper than a full cell process

For the best commercial samples of plantation rubber taken from a consignment of not less than 50 cases—the consignment to be representative of the grades actually turned out under present conditions—the Rubber Growers' Association (Incorporated) is offering gold and silver medals and cash prizes at the forthcoming Sixth International Exhibition of Rubber and other Tropical Products to be held in Brussels in April. At least five of these awards, all of equal value, are offered in respect of the various producing countries of which the following have so far been specified: Malaya, Ceylon, Netherland Indies, South India and Burma and Borneo. The lesser rubber-producing countries will be provided for if necessary.

Mr. S. H. Davies, M.Sc., F.I.C., one of the Governors of the Imperial College of Tropical Agriculture, delivered two interesting lectures last November before the Royal Society of Arts on "The Cultivation of Cacao in British Tropical Colonies." In Nigeria the Government is setting up co-operative "fermenteries" and in other ways assisting that country's developing industry. In connection with Mr. Davies' remark that considerable ignorance prevails as to the manner of cacao pollination, it may be mentioned that recent observations and experiments in Trinidad have thrown new light on this matter and it may now be claimed that the phenomenon is no longer hidden in obscurity.

The London Chamber of Commerce reports that the prospects for an increased production of sugar in Portuguese East Africa have been excellent. It is believed that the total output for 1923 will be found to be nearly 60,000 metric tons as compared with 50,000 tons in 1922. Of this quantity, 25,000 tons are reserved for Portugal and 1,500 tons for the Province. The remainder will probably be shipped to the United Kingdom and the Continent. Hitherto, most of the sugar has gone to the Transvaal and the Union of South Africa, but the termination of the Mozambique Convention has closed that market to local producers. European prices are good, however, and the companies are preparing to extend their production in every way possible.

Sir Charles W. Macara, Bart. (ex-President of the English and International Cotton Federations), writes hopefully of the future of the Lancashire Cotton Industry in a recent issue of the Empire "Mail." Amongst other interesting facts he records that out of the world's 156 million spindles, Great Britain owns 56,583,000, the United States 37,250,000, France 9,610,000, Germany 9,605,077 and Japan 4,483,000. Eleven to twelve million spindles in Great Britain are required to supply the home market and the same is probably needed, thinks Sir Charles Macara, in most other countries of similar size. The point, however, in regard to the significance of spindle statistics is, we think, their rate of increase in recent years rather than their total number at the present time. It is a matter of progressive ratios rather than of totals.

A great deal of research has been done in this connection in South as well as in East Africa. An important feature of this work has been the assistance rendered by the Imperial Bureau of Entomology, the Assistant Director of which institution is now in the West Indies.

RESEARCH IN BIOLOGY.

DIE-BACK OF THE LIME IN MONTSERRAT.—A recent paper by Dr. T. G. Mason, lately of the Imperial Department, and late Professor of Botany in the Imperial College of Tropical Agriculture is of special interest to planters as the latest contribution to the solution of a problem which has engaged attention for many years.

The paper in question is entitled "Ligneous Zonation and Die-back in the Lime (*Citrus medica* var. *acida*)," and will be found in the "Scientific Proceedings of the Royal Dublin Society," Vol. 17 (N.S.) pp. 255, 262, August, 1923.

The problem is that afforded by the behaviour of the Lime under cultivation in certain islands of the Lesser Antilles, notably Montserrat. If suitably protected when young, the trees become established and do well for about ten years, bearing normal crops, but after that period of time the most exposed trees begin to show signs of disease, which usually, sooner or later, spreads over the entire field.

The disease, which is known as die-back, has been fully described by Nowell (Diseases of Crop-Plants in the Lesser Antilles, West India Committee 1923). Briefly, it may be stated that the young leading shoots of the branches lose vigour and die, and are replaced by laterals, which in turn suffer in the same way. At the same time the trees nearly always become infested by scale insects, and by a fungus of the genus Diplodia, which attacks the dying shoots, and the roots. The roots also suffer more from the attacks of weevil larvae, owing to inability to repair wounds.

The history of the investigation into the causes of this condition is interesting, not only in itself, but also because it is typical of the changes which have taken place in plant pathology during the past thirty years.

The trouble dates back almost to 1852, when lime cultivation began to be important in Montserrat. During the period up to 1894 attention was concentrated on the chemical nature of the soil which it was thought might be deficient in some of the essential plant nutrients. Soils were analysed and various manures tried, but without much success.

In 1894 entomologists took up the question of controlling the scale insects, and experiments in spraying and fumigating were made, and continued for several years. These experiments were not very successful, and it was thought that the treatment probably did more harm to the natural enemies (both insect and fungus) of the pest than to the pest itself. The next line, therefore, was to encourage as far as possible, these natural enemies on scale insects, and several active fungi were found, the use of which certainly did reduce the infestation, but without materially altering the die-back.

Towards the close of this period, about 1907, it was realised that scale insects alone were not responsible for the die-back, and in the Montserrat Botanical Station Report for 1909-10, reference is made to the injuries of the root. After this, whilst the attack on scale insects was still carried on, attention was also bestowed upon root diseases.

Of recent years the tendency among plant pathologists, both entomologists and mycologists, has been to recognise more and more that, important as insect pests and fungous diseases are, the physiological condition of the host plant is often the first factor in the incidence of disease.

This is particularly true in the case of the Lime in Montserrat, and this point is found emphasized in a report by Messrs. Ballou and Nowell (Entomologist and Mycologist respectively to the Imperial Department of Agriculture) on a visit to Montserrat in 1915. (Report on the Agricultural Department, Montserrat, 1915-16.)

Since the mass of evidence collected pointed to the irregularity of the water supply as the important factor in the situation, the Chemist and Botanist in 1921 investigated the problem more thoroughly from this viewpoint. Prof. Hardy examined soils from lime estates where the trees were dying back, and from those where they were healthy including for comparison soils from Dominica and Antigua. (*West Indian Bulletin* Vol. 19, No. 2 pp. 189-213.)

Dr. Mason collected shoots from trees on the same estates and examined them microscopically.

It is a well known fact that a tree bears in the structure of its wood evidence of its past history. In the trees of temperate regions the familiar annual rings are due to conspicuous differences between the wood formed in spring when growth is vigorous, and that laid down in autumn when growth has slackened off.

Mason found that the shoots which came from healthy trees showed a fairly regular zonation, and that where parenchyma occurred among the vessels it was regularly distributed in radial rows probably indicating that the cambium was checked in activity by lack of water during parts of the dry season. In shoots from trees showing die-back the bands of parenchyma were more sharply marked off from the vessels and did not occur in groups along the radii the activity of the cambium being checked at irregular intervals throughout the year.

These results are correlated with Hardy's. The interpretation is cautious, but it is concluded that rapid and repeated fluctuations in the water supply of the growing tissues is at least an important factor in causing die-back.

Additional evidence in support of this view is drawn from a comparison of the behaviour of the Lime in St. Vincent and Carriacou, which may be quoted from Dr. Mason's paper *verbatim*:—

"The annual rainfall in St. Vincent is about 100 inches, and the soil is shallow and porous, drying out with great rapidity whenever a couple of weeks pass without rain. The annual precipi-

tation in Carriacou, on the other hand, is only about 40 inches, but the soil is very retentive, and dries out slowly. The consequence is that in the dry season St. Vincent undergoes rapid though normally short-lived spells of drought, whereas in Carriacou drought conditions are initiated relatively slowly as a result of the retentive nature of its soil, but are frequently prolonged. Now the Lime cannot be grown in St. Vincent, though repeated attempts have been made to do so, while it thrives in Carriacou, where the aridity is many times greater. It would seem that this plant can tolerate considerable aridity and still thrive, but that it is unable to withstand a rapid desiccation of its tissues."

E. E. C.

A Note by Mr. J. L. Webb (Journ. Econ. Entom., XVI., Dec., 1923, p. 544) brings to notice a further potential pest of cotton, a pink bollworm (*Thurberiphaga catalina*) found on a wild cotton (*Thurberia*).

The larva of this insect feeds within the bolls of *Thurberia* growing on the mountains of Arizona at altitudes of between 3,000 and 4,800 feet. It was estimated that in the Sabino Basin region 35 per cent. of the insects were destroyed by natural enemies, 29 per cent. of these being internal parasites. The pink bollworm of *Thurberia* is regarded as a serious menace to cotton grown in the valleys of Arizona below the range of the *Thurberia* plant.

Interesting work is being carried on by Mr. R. H. Harris in Zululand on the control of Tsetse flies (Journ. Dept. Agric., South Africa, 1923, VII, pp. 11 and 389). This biting fly is of course well-known as the carrier of that great cattle scourge nagana.

Mr. Harris has discovered that tsetses are attracted to animals mainly by the sense of sight and consequently they will come in numbers to a dummy animal. The flies usually settle upon the legs and therefore it seems feasible to capture the flies by coating the legs of the dummy with some sticky material. So far an entirely satisfactory adhesive has not been found.

Comparisons of the attractiveness of a zebra with the dummy show that the latter is far more efficient, the dummy attracting more than three times the number of flies each day. Probably the zebra, on account of its striped body is less conspicuous.

A Chalcid parasite of the Tsetse fly has also been found by Mr. Harris. One fly puparium yielded 76 parasites.

Considerable attention is now being given in Trinidad to the question of greater utilization of the local timbers. In this connection an interesting note on local woods for marine piles will be found in "The Bulletin" of the Department of Agriculture (Vol. XX, Parts II to IV).

COLLEGE NEWS.

THE College re-opened on January 7. Term ends March 22.

Mr. P. E. Turner, B.Sc., A.I.C., arrived on January 19, to take up his appointment as Demonstrator in Chemistry.

Mr. G. Frecheville, B.A., Oxford, arrived from England on January 5, to take a course of postgraduate studies in plant physiology and plant breeding. Mr. Frecheville also proposes to devote some time to certain aspects of economics.

Mr. R. G. W. Farnell, A.R.C.S., A.I.C., chemist to the British Empire Sugar Research Association, who first visited Demerara in 1922 to gain first-hand experience in the manufacture of sugar, has been working at the College since January 1923, studying the colloids present in cane juice (*i.e.* pectin, gum, protein, &c.), as will be seen on another page. Progress has been made in methods for their elimination. Mr. Farnell leaves the College on January 19, to attend the Agricultural Conference in Jamaica and after visiting the sugar factories there, sails for England, thence to Natal, Mauritius and India for the further prosecution of his studies.

Sir Arthur Shipley, G.B.E., F.R.S., Chairman of the Governing Body of the Imperial College of Tropical Agriculture, and Mr. A. E. Aspinall, C.M.G., Secretary of the College and of the West India Committee, left Trinidad for British Guiana on January 5.

Sir Arthur Shipley in the course of his visit to British Guiana gave a powerful address before a large meeting on the aims and work of the College. At the conclusion of the address Mr. R. E. Brassington, M.C.P., expressed his appreciation of the work which the College was doing and promised it his warmest support in Council.

Sir Arthur Shipley and Mr. Aspinall returned to Trinidad on January 12 to be present at the ceremony of the laying of the foundation stone of the new building before proceeding to Jamaica on January 19 with the other delegates to the Conference.

Considerable improvements are being effected in regard to the organization of the stock farm at St. Joseph, by the Trinidad Department of Agriculture. Milk records have been kept now for nearly two years and the recent innovation of weighed rations and apportionment of rations on the basis of milk-yielding capacity of the cows, will in all probability furnish results of much interest and value. The relative cost of feeding home-grown versus purchased foods is being given attention and this together with the work in connection with pigs and stock other than cattle constitutes a distinctly refreshing turn in the direction of the rational management of tropical livestock. The College has much to be thankful for in having free access to this stock-farm.

TREND OF THE MARKETS.

(*The notes below are based principally upon running charts of the prices of the basic grades and upon general statistical information gleaned from contemporary publications and cablegrams and are intended to be a record of movements. An attempt is made, where possible, to indicate the market outlook at the time of going to press, but no responsibility for the accuracy and subsequent truth of such observations is assumed. Unless otherwise stated the prices quoted are spot, London*).

COTTON.—From previously high levels of Middling Upland at the end of December, the trend of daily prices in New York during January was downward to 19 cents which was the level in mid-December. As a result of schemes in progress in the West Indies for growing new varieties of cotton which would obtain a higher price than Sea Island which was then nominal the price of this cotton rose early in December and on January 13 was quoted at 2*s*. per lb. on the London market.

SUGAR.—A sudden decline occurred in the price of sugar on January 8 probably due to the fact that the Cuban crop was then coming on the market. Towards the middle of January Cubans duty paid New York were in the neighbourhood of 6.70 per 100 lb. Outlook promising.

TEA.—The reaction which set in early in November when Indian average dropped from 19¼*d*. per lb. to 18*d*. per lb. has shown a firmer tendency during December the average price being 18¼*d*. per lb.

CACAO.—The rise in Trinidad Cacao reported in last issue on December 10 reached 9 cents per lb. in New York during the end of December and beginning of January. Prices eased a small fraction of a cent. The rise appears to have been due to increased purchases by Germany. The rise of Trinidad on December 18 was accompanied by a slight fall in Accras. The recent decline appears to be connected with depreciation in European exchange particularly French.

COFFEE.—The demand for coffee continues to be very firm. Brazil Santos in the end of December was 70*s*. a cwt.

COPRA.—The price of good Eastern copra has risen steadily to £32 a ton in the middle of December. This was followed by a slight fall to a more normal level. Copra has been rising rapidly since August. Price in Trinidad at January 19 was $5.30 per 100 lb.

RUBBER.—After the mid-November recovery rubber declined during the middle of December to 1*s*. 2*d*. per lb. In mid-September rubber was 1*s*. 4*d*. Outlook for the new year better.

SISAL.—Prime Sisal has shown a very firm tendency rising from £35 a ton at the end of October to £37 towards the end of December.

RICE.—Rice has shown a tendency to rise during December. Burmese was £17 10*s*. a ton on December 20.

INDIAN COFFEE STATISTICS.—The coffee industry of India is practically confined to South India, comprising the Madras Presidency, Coorg, and the State of Mysore, Travancore, and Cochin, and an important statement in regard to production in 1922-3 has recently been issued by the Director of Statistics. Except for areas of under 10 acres, all coffee estates in India are included.

The number of reporting plantations in the year under review was 2,998 covering an area of 227,676 acres, as against 2,964 with an area of 216,746 acres reported a year ago. New land planted with coffee in these plantations during the year amounted to 7,224 acres, while the area of old cultivation abandoned was 2,842 acres. This represents a net increase of 4,382 acres over the total area (127,273 acres) under coffee for 1921-22. The total reported area under cultivation in the year 1922-23 was, therefore, 131,655 acres, or an increase of 3 per cent. over that of the preceding year. Of this total area, Mysore accounted for 52 per cent., Coorg 24 per cent., Madras 22 per cent., and Cochin and Travancore together 2 per cent.

The total reported production of cured coffee during the year was 25,467,687 lb., as compared with 20,586,644 lb. (revised) in the preceding year —the yield per acre of plucked area being 296 lb. (202 lb.) in Madras, 251 lb. (182 lb.) in Coorg, 177 lb, (179 lb.) in Mysore, 149 lb. (49 lb.) in Travancore and 126 lb. (128 lb.) in Cochin. The figures for 1921-22 are shown in brackets.

The daily average number of persons employed in the plantations during 1922-23 was returned at 67,903, of whom 41,717 were permanently employed (namely, garden labour 28,012 and outside labour 13,705) and 26,186 temporarily employed (outside labour), as compared with 69,201 persons (26,209 garden and 15,827 outside labour permanently employed and 27,165 temporary outside labour) in 1921-22.

The Hon. Dr. H. A. Tempany and France Giraud have recently published a paper on the application of molasses as a fertilizer to cane soils in Mauritius (*Bulletin No.* 28 Mauritius Dept. of Agric.). Planting practice in Mauritius favours the application of molasses to cane fields and evidence goes to show that such applications occasion considerable increases in yield. Rates of application range from 4 to 15 tons per acre. The correctness of this view was originally indicated by experiments conducted by Boname and confirmed by two separate sets of experiments the results of which indicate that in virgin land the increase in yield resulting from applications of molasses under the conditions of experiment may be expected to amount to 9·65 tons of cane per acre. Considerations arising from other experiments show that these increases are too large to be attributed entirely to the plant food conveyed by the molasses to the soil; consequently some other contributing cause must be sought; this is probably biological in nature.